Space Weather Technical Forecast

Issued on Monday, 05 August 2024 at 13:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Further M-class flares expected with a chance of isolated X-class flares

Analysis of Space Weather Activity over past 24 hours

Solar Activity: High with five M-flares observed in the last 24 hours, peaking M6.1 at 05/0523 UTC. This was an impulsive flare from the westernmost portion of AR3780, near the southeast limb. This is the largest, and most notable of the nine regions currently on the solar disc, however it appears relatively stable with any apparent growth likely due to the decreasing viewing angle as it moves away from the limb. Also of note is moderately sized AR3774, just east of the south-centre disc. This has seen some growth of small spots, mainly around its trailer region, but has remained relatively stable. AR3772 in the south-centre has continued to simplify into a moderately sized bipolar configuration, having lots its small delta spot within its intermediate region. The other regions remain smaller and stable at this time.

No Earth-directed CMEs have been observed, however a narrow CME was produced off the east disc with the M6.1 flare, along with a couple of filament eruption CMEs off the southeast and northeast that have yet to be assessed. These are unlikely to have Earth-directed components.

Solar Wind / Geomagnetic Activity: Ongoing CME influence at first, from the 01 Aug CME arrival, was followed by further weak transient arrivals, perhaps with some element of fast wind from an unknown source. Solar wind speeds were initially background, below 400 km/s, but rose slightly, but sharply at 04/2123 UTC to be slightly elevated at 410km/s. A further more gradual increase then occurred from 05/0300 UTC, with solar winds becoming elevated, peaking just over 500km/s by 05/0600 UTC. These winds then eased slightly to be slightly elevated at around 460-500km/s. Density remained at or below average, but also showed a slight and brief rise at 04/2120 UTC. Interplanetary Magnetic Field, Bt, was Moderate to Strong, ranging 10nT to 21 nT, with peaks occurring at 04/1230 UTC, and 04/2126 UTC, before easing to be Weak to Moderate after 05/0630 UTC. The north-south component was initially strongly negative with minimum -18nT at 04/1250 UTC, but then rotated from 04/1615 UTC to mainly positive, including a strong maximum of +19nT at 05/0015UTC. Geomagnetic activity was initially G3 Strong storm (Kp 7), but eased from 04/1800 to be Unsettled to Active (Kp2-4).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels. The 24-hour fluence was below the Active threshold with 8.85e5 integrated pfu observed at 05/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate to High solar activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares.

Solar Wind /Geomagnetic Activity: Further weak transient effects are possible at first, but these are expected to ease later day 1 and into day 2 (05-06 Aug) with solar winds then likely to ease. No further notable enhancements are currently forecast through the period. Mainly Quiet

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geomagnetic activity is expected with a chance of isolated Unsettled intervals. There is a slight chance of Active to G1 Minor Storm intervals, mainly on day 1 (05 Aug).

Energetic Particles / Solar Radiation: High energy proton flux is currently at background levels. Should any notable flares occur, especially in the western disc, there is the potential for flux to rise with a slight chance of exceeding the S1/Minor Radiation Storm threshold. The high energy electron flux is forecast to be at mostly background levels. The associated 24-hour fluence will probably remain below the Active threshold (1e8 integrated pfu) throughout.

Figure 1a. BGS Geomagnetic activity

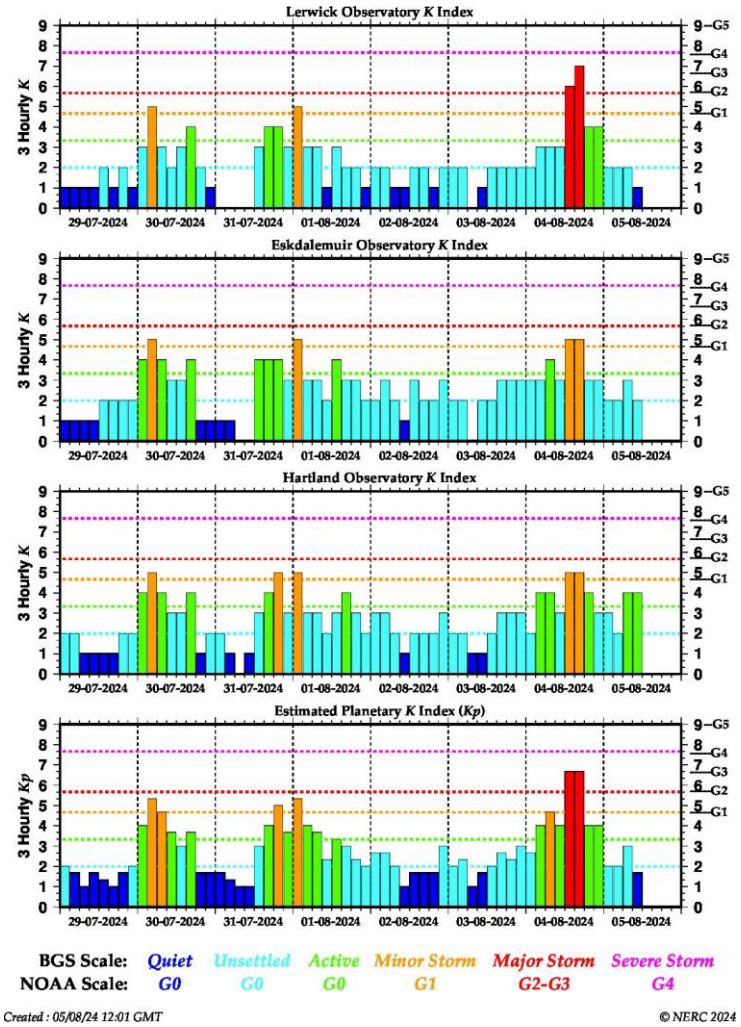

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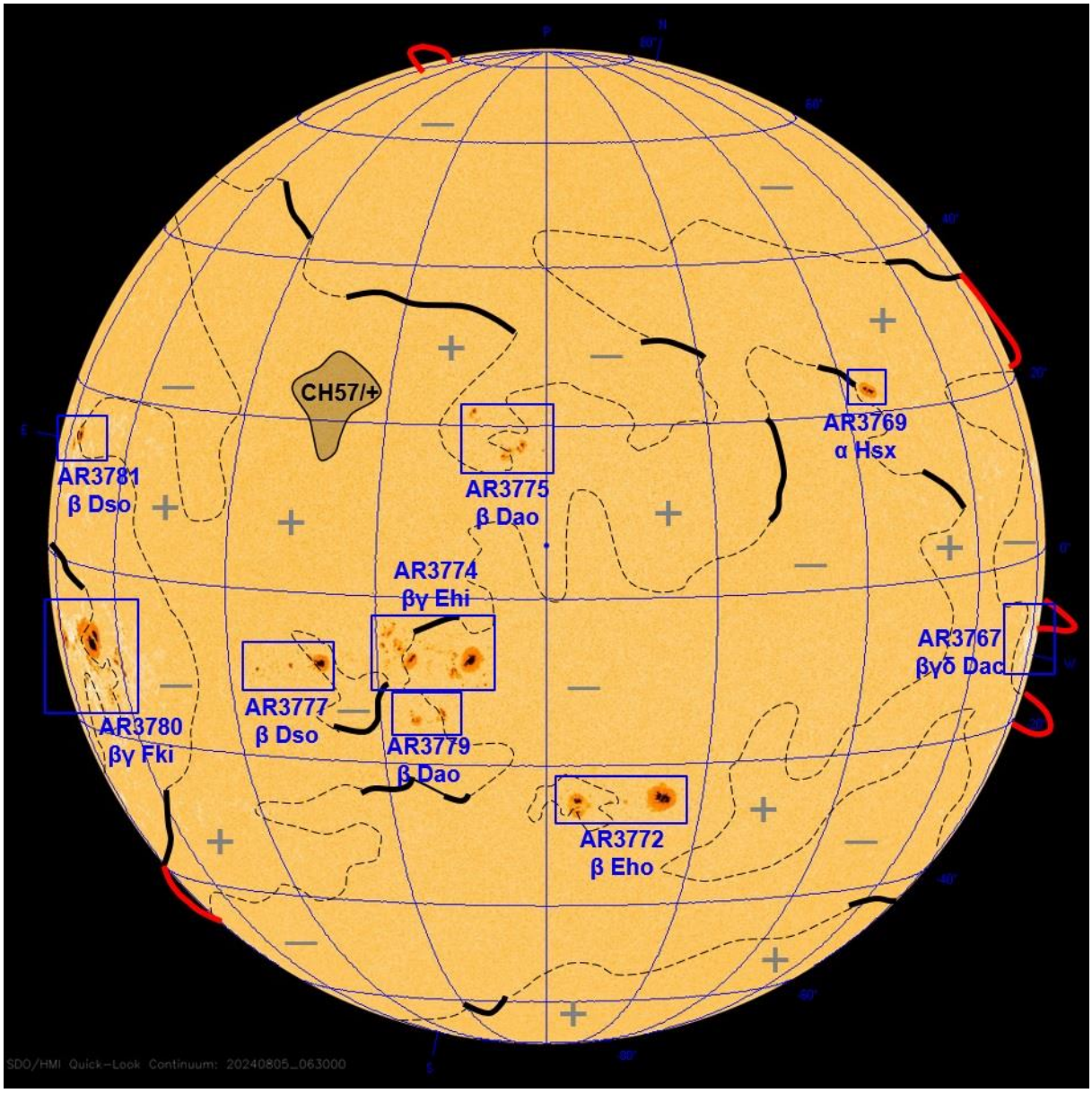
Figure 1b. Solar Analysis Valid 05/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Due to the large number of coincident CMEs in recent days, including those off the Earth-Sun line, confidence in the recent CME analysis remains lower than usual. While no Earth-directed CMEs are currently modelled, there remains a potential for weak transients which may give slight enhancements on day 1 (05 Aug).

Solar winds are currently slightly elevated, however the source of this enhancement is uncertain with no clear coronal hole identifiable in SDO imagery. It is possible that this enhancement was due to a weak transient, however, and solar winds are likely to ease day 2 (06 Aug) onward as this influence recedes. With no further coronal hole features anticipated to influence the solar environment, a trend to mainly Quiet geomagnetic activity is expected, with Unsettled intervals. There remains a slight chance of Active to G1 Minor storms on day 1 (05 Aug).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	10	5	1	5
Strong	G3	Yes	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: L1 Solar Winds (ACE) for the last 24 hours

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Radio Blackouts - X-Ray Flares:

Moderate to High activity is expected with further M-class flares expected and a chance of isolated X-class flares.

There are nine sunspot regions on the disc. The largest is AR3780, and currently appears to be comprised of a large negative leader spot, with smaller trailers, and a large number of mixed polarity smaller spots to its south and southwest. However this is currently a difficult region to accurately assess due to its near limb location, and may yet be split into a few smaller regions.

Elsewhere moderately sized AR3774 in the centre disc also shows some complexity, with the mixed magnetic polarity of its surrounding small spots, but remains largely stable. AR3772, while a relatively simple and now open spot, with its intermediate spots fading, remains bright on aia-94 imagery, perhaps suggesting a greater potential for flaring than its simple classification would indicate. The other regions are smaller and simpler, although AR3767 has now rotated onto the west limb and will soon move ono the far-side.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	90	90	80	80
Very Active	R3 to R5 X Class	No	20	20	20	20

Figure 3: GOES 16/18 X-ray flux

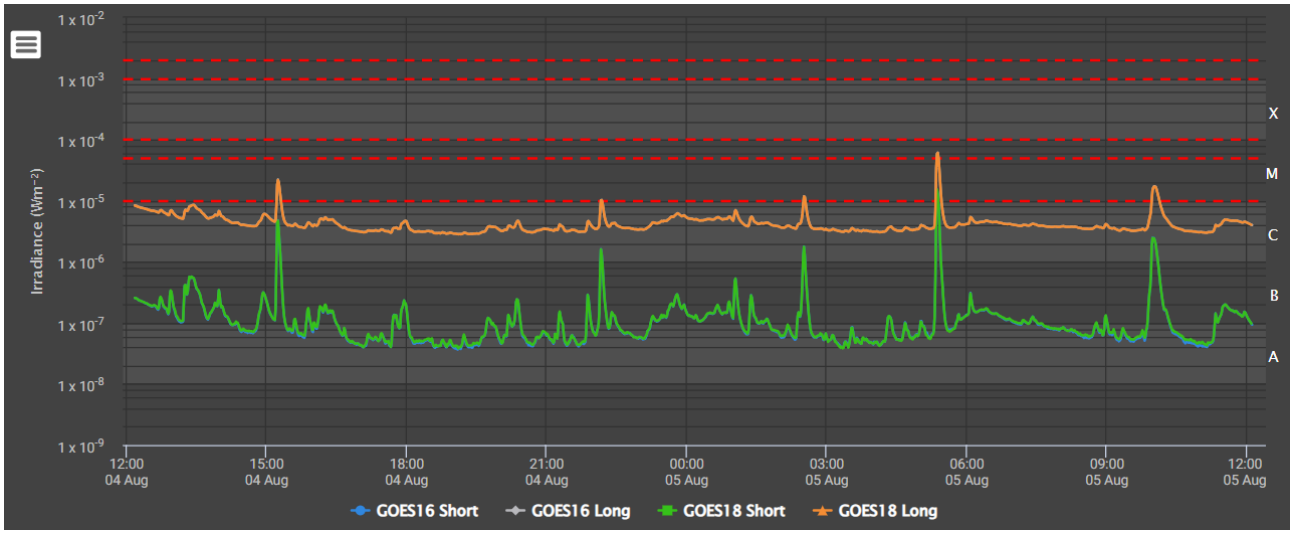

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Figure 3b: SDO imagery of SE limb showing AR3780

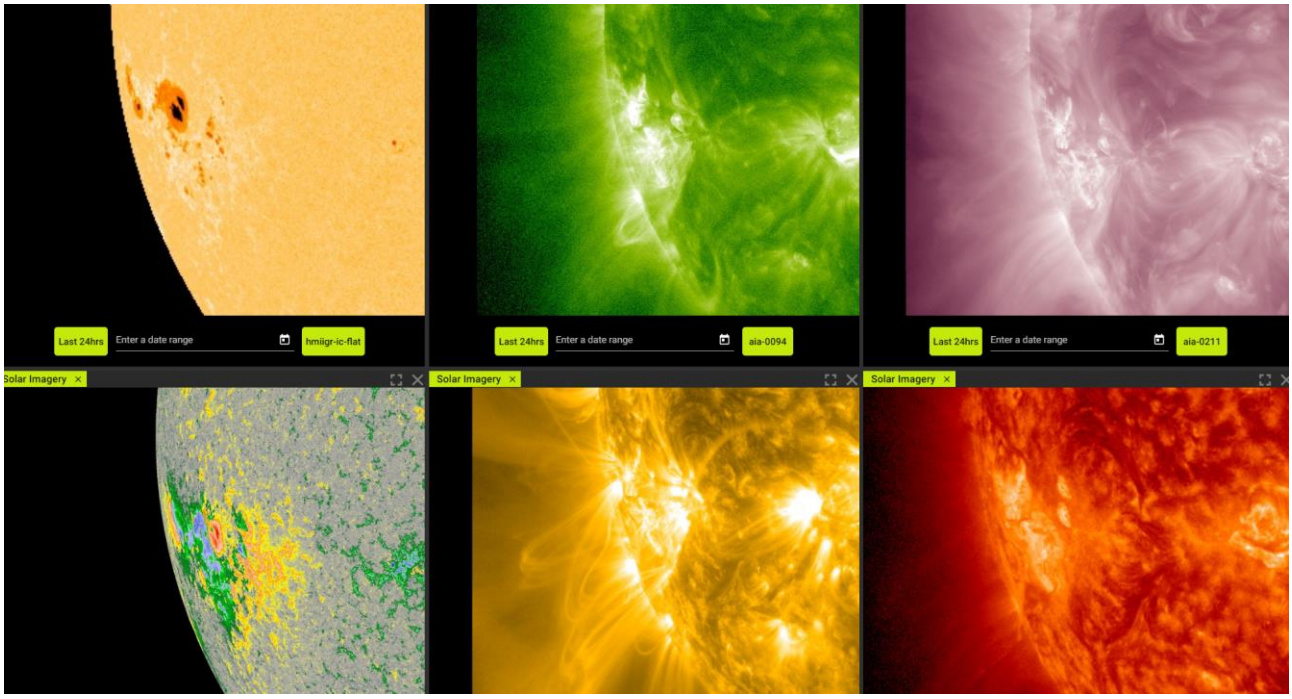
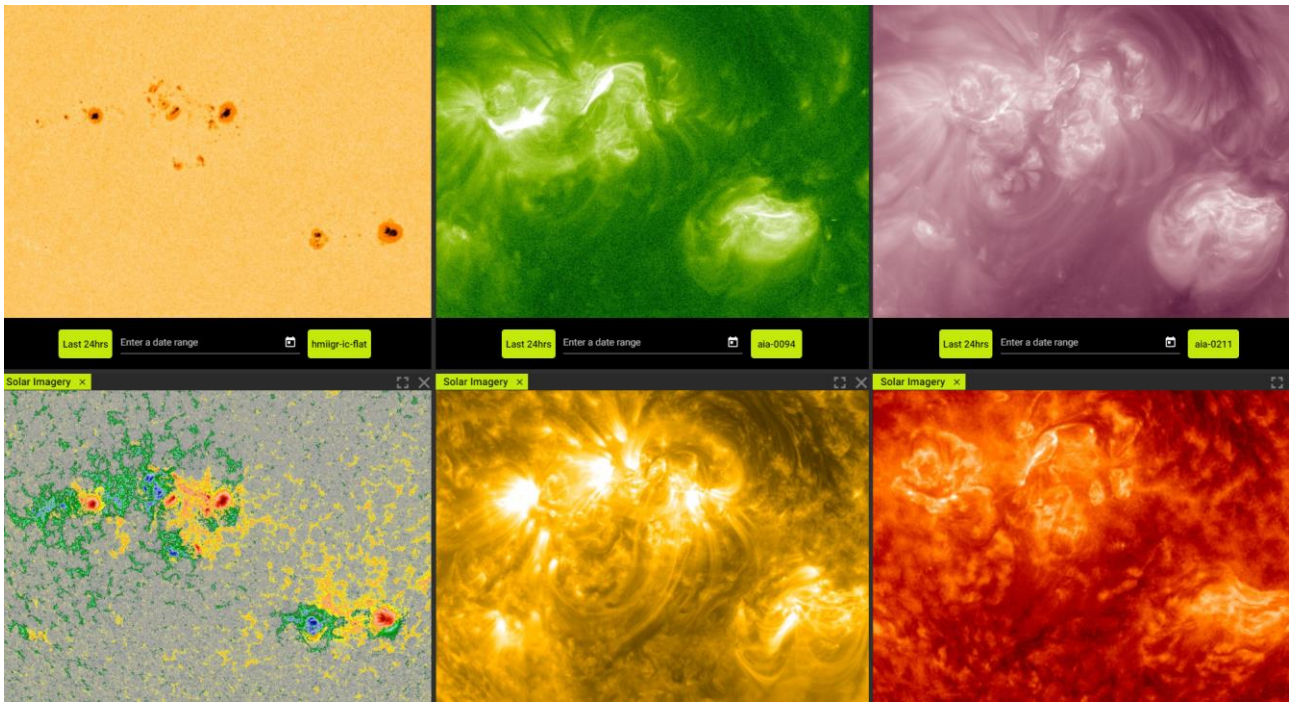


Figure 3c: SDO imagery of South-centre disc, showing AR3777, AR3774, AR3779, AR3772.



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is currently at background levels but has the potential to rise in response to any notable flares on the disc, particularly those from the west of the disc or just beyond the west limb, such as AR3767. This will bring a slight chance of reaching the S1 Minor Radiation storm level

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	15	15	15	15
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux, as observed by GOES-16, is currently at background, however some enhancement has likely occurred below GEO due to the recent activity from the CME arrival on 04 Aug. In the absence of any notable fast wind arrivals, the observed flux is expected to remain at or near background levels, perhaps rising to Moderate as the Van Allen Belts relax outward.

The associated 24hr electron fluence is expected to remain below Active (1e8 integrated pfu), but perhaps with a slight rising trend, as indicated in MOSWOC REFM.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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